RP-5 Renewable Energy Efficiency Project

Quarterly Technical Report

July 1, 2003 – September 30, 2003

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ABSTRACT

This is the fifth quarterly technical report for the RP-5 Renewable Energy Efficiency Project. The report summarizes the work progress, effort and activities that took place during the period from July 1, 2003 through September 30, 2003. The report has been prepared in accordance with the Department of Energy (DOE) Guidelines.

IEUA has received and evaluated consultant proposals for the design and construction services for the RP-5 Renewable Energy Efficiency Project. IEUA has interviewed two consultants to discuss their proposals and clarify issues associated with the project's scope of work, schedule and costs.

IEUA has also prepared a separate special report on the status of the project, including the project's history, progress, current design, an updated equipment list, and fuel cell technical and economical analysis. The report discussed in length the pros and cons of the fuel cell system and gas clean up system requirements.

IEUA met with Stirling Energy Systems (SES) to discuss the terms and conditions for hosting a 25 kW Stirling Engine at the RP-5 plant site for testing it on digester and natural gas.

IEUA is also evaluating a 25 kW flexible microturbine developed by FlexEnergy. The flexible microturbine runs on digester and natural gas. Performance verification and emission measurements are part of the research and tests to be conducted. IEUA is considering locating the flexible microturbine at Regional Plant No. 1 (RP-1) where the microturbine will burn a low quality digester gas that cannot be used by the internal combustion (IC) engines.

IEUA has installed a 60 kW Photovoltaic (PV) power generation system on the roof of the new headquarters building.

A matching funds update is also included in the Results and Discussion section. The update presents the work effort performed by CH2M Hill, the PIER Consultant, and the associated costs that serve as matching funds for the RP-5 Renewable Energy Efficiency Project during this report period.

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INTRODUCTION

There are five major tasks that are addressed during this report period. These tasks are listed below:

- Consultant Proposals Evaluation and Interviews;
- Project Status and Fuel Cell Analysis Report;
- Stirling Engine;
- Flexible Microturbine; and,
- PV System for Agency's headquarters.

Consultant Proposals Evaluation and Interviews

Consultant proposals for the design and construction services for the RP-5 Renewable Energy Efficiency Project were received on July 14, 2003. Participating consultant firms include Parsons Corporation, CH2M Hill, Montgomery Watson Harza and DMJM. A proposals review panel evaluated all proposals and ranked each consultant based on proposal completeness and compliance with the Request for Proposal (RFP) requirements, project team and past experience. IEUA interviewed CH2M Hill and Parsons Corporation for further discussions of their proposals including qualifications and project approach. After the first round of interviews, Parsons Corporation was called for another interview to discuss project scope, cost and overall schedule in more details. The project will be awarded to the successful consultant as soon as the DOE advises IEUA to proceed.

Project Status and Fuel Cell Analysis Special Report

IEUA prepared a special report for the DOE to explain limitations associated with fuel cell technology at the present time. As the fuel cell technology is significantly advancing in terms of performance and heat recovery, IEUA recommended deferring the procurement of the fuel cell at this time and incorporating the newer fuel cell technology into the project when it is available.

IEUA also recommended for DOE's consideration that IEUA move forward with the demonstration of and innovative and never-before-tested combination of primary and secondary generation systems that use biogas while achieving energy efficiencies of 65% or larger.

IEUA further proposed to add a "Phase III" to the project that will integrate the newest fuel cell technology into the project design as soon as it is available.

Stirling Engine Hosting Agreement

IEUA and Stirling Energy Systems (SES) have established communications since the November 4, 2002 Conceptual Design Kickoff Meeting to discuss the available options

and strategies for testing a 25 kW Stirling engine at one of IEUA's facilities. The Stirling engine will be installed near the new headquarters building absorption chillers system pad, and will be tested on biogas fuel including manure digester gas as well as natural gas. Phase I of this demonstration project will only involve running the engine on both fuels one at a time starting with natural gas. The engine's combustion stability and performance will be evaluated by SES. IEUA will host the engine and provide a concrete pad, enclosure, cooling water and gas piping, and electrical connections.

Flexible Microturbine

The flexible microturbine technology was introduced during the November 4, 2002 Conceptual Design Kickoff Meeting. FlexEnergy and IEUA have been discussing the options of hosting the flexible microturbine and testing it at one of the IEUA's facilities using low quality fuel gas. According to FlexEnergy, the flexible microturbine can run on any low quality fuel gas or foul air with 2 percent methane tracing. IEUA has sampled and analyzed gas and foul air at three locations at RP-1 and RP-5. RP-1 digester gas coming out of the acid digester No.1 was found to be the best and only source of low quality fuel gas. Foul air at RP-1 and RP-5 did not have any methane in it, and therefore, cannot be used as fuel. See Appendix A for gas and foul air analysis summary. The flexible microturbine prototype shop test was commenced on July 23, 2003 and it is still going on. Diluted natural gas with air is being used as the primary fuel.

IEUA's Headquarters Photovoltaic (PV)

IEUA is involved with an additional innovative project that is outside of the scope of the RP-5 Renewable Energy Efficiency Project. IEUA has installed a 60 kW photovoltaic (PV) power generation system on the roof of the new headquarters building. The PV system will produce power once Southern California Edison gives IEUA an interconnection agreement. The PV system includes 2-20 kW PV panels and 10-2 kW panels. This project is one of the activities of the California Energy Commission (CEC) PIER Program.

EXECUTIVE SUMMARY

The RP-5 Renewable Energy Efficiency Project continued its progress towards the selection of a consulting engineer for the project and commencing the preliminary design phase. Activities that took place during this report period are summarized as follows:

- Consultant Proposals Evaluation
    - Consultant proposals were received on July 14, 2003;
    - Participating consultants include Parsons Corporation, CH2M Hill, Montgomery Watson Harza and DMJM;
    - All proposals were technically evaluated and reviewed by the review panel members who performed an independent evaluation of each proposal;
    - Per review panel recommendations, IEUA interviewed CH2M Hill on July 30, 2003;
    - Per review panel recommendations, IEUA also interviewed Parsons Corporation on July 31, 2003;
    - IEUA interviewed Parsons Corporation for a second time on August 28, 2003 for further project scope, cost and schedule discussions; and,
    - Consultant interview and award process was put on hold until the fuel cell issue is resolved.
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- Project Status and Fuel Cell Analysis Special Report
    - The report was prepared to address the DOE's concerns in regards to the project status and deferring the fuel cell until a later date when better and newer fuel cell technology is available;
    - Technical and economical evaluation and analysis of the fuel cells and associated gas cleaning system were conducted by Camp Dresser and McKee; and,
    - The report provided a project history, current scope of work, information regarding innovative technologies introduced to the project, revised schedule, and overall recommendations regarding the project;

- Stirling Engines
    - IEUA met with Stirling Energy Systems (SES) on August 28, 2003 to discuss their proposal for testing a 25 kW Stirling engine at the RP-5 site;
    - SES submitted a memorandum of understanding (MOU) explaining the nature of the this innovative technology task and its terms and conditions;

- IEUA developed an agreement for the implementation of this task along with the responsibilities of each party;
- SES is currently testing the Stirling engine burner for stability at a university laboratory in the State of Arizona; natural gas is being used as engine fuel;
- Phase I of the task involves testing the Stirling engine at RP-5 on natural and digester gas; Phase I will be partially funded by the California Energy Commission (CEC) under the PIER II Program;
- Upon completion of Phase I, SES will seek additional funding for Phase II;
- Phase II of this task will involve power generation and emissions evaluation; and,
- Stirling engine testing at RP-5 is anticipated to commence by the end of February 2004.

- Flexible Microturbine

  - FlexEnergy has started the flexible microturbine prototype test in July 2003 at Capstone's workshop in Chatsworth, California; the test is still in progress;
  - Endurance, stability, performance and emission are the main parameters that are being evaluated. FlexEnergy indicated that test results look very good so far;
  - IEUA and FlexEnergy met on October 6, 2003 to discuss the FlexEnergy proposal and finalize the agreement which will control this innovative task implementation;
  - FlexEnergy will provide the flexible microturbine package along with the gas cleanup system, while IEUA will provide a concrete pad, water, digester and natural gas piping, and electrical connections; and,
  - IEUA has taken several gas and foul air samples at various facilities to determine the best location for the flexible microturbine; RP-1 was found to be a suitable site with the availability of low quality digester gas that is currently being flared. See Appendix A for gas analysis summary results.

EXPERIMENTAL

The RP-5 Renewable Energy Project throughout the conceptual design and research phase, and through the preliminary design phase, will continue to use standard research methods and equipment such as computers, phones, internet, etc. The methods and steps that have been utilized in this project include, but are not limited to the following:

- Manufacturers' survey, communications, literatures, catalogues, etc.;
- Technical workshops;
- Communications with leading experts;
- Communications with environmental control agencies;
- Manufacturers' plant visits;
- Evaluation of specific factory test results for selected equipment;
- Feed back from owners of existing installations;
- Economic evaluation;
- Life Cycle analysis; and,
- Payback calculations.

RESULTS AND DISCUSSION

Consulting contract negotiation with Parsons Corporation is near completion. IEUA is waiting to hear from the DOE on the fuel cell issue. The contract is expected to be awarded some time in November 2003 if DOE agrees with IEUA's recommendations and approach.

IEUA is looking forward to reaching a resolution on the fuel cell issue and receiving an approval from the DOE to proceed with the current project design and configuration. IEUA recommended introducing a "Phase III" for the project where the fuel cell could be incorporated into the project some time in the future when the fuel cell technology becomes more reliable and cost effective.

As for the innovative demonstration projects, agreement for hosting and testing a 25 kW Stirling genset is near completion and is anticipated to commence sometime in February 2004; a meeting between FlexEnergy and IEUA was held to discuss the responsibilities of each party regarding hosting and testing the flexible microturbine. The agreement is expected to be finalized early November 2003, depending on FlexEnergy's schedule and arrangements with Capstone.

Matching Funds

The RP-5 Renewable Energy Efficiency Project and the California Energy Commission funded Commonwealth Energy Public Interest Energy Research (PIER) program to make renewable energy more affordable are closely linked and mutually beneficial. The PIER

program is intended to foster the development of renewable energy demonstration projects in the Chino Basin. This program includes projects involving biogas from dairy waste and wastewater treatment plants as well as general planning and analysis activities. Relevant PIER Program activities include the Planning and Analysis Project (Project 1.1), the Enhanced Energy Recovery at Waste Water Treatment Plants Project (Project 2.2), and the Dairy Waste to Energy Project (Project 3.1). In the current reporting period work was undertaken on several tasks in Project 1.1 directly linked to the RP –5 Renewable Energy Efficiency project. This work included tasks totaling approximately $135,000, which serve as matching funds for the RP-5 Project. In addition, tasks under Projects 2.2 and 3.1 were initiated. Matching funds for those projects total approximately $24,000. Therefore, overall matching fund expenditure for this period total $159,000. Additional expenditures on Project 1.1, 2.2 and 3.1 will be presented in future quarterly reports.

Other parts of the matching funds include the time and effort that IEUA has spent working on the renewable energy project, and also the Contractor's time and cost for the central plant equipment and construction.

CONCLUSION

The RP-5 Renewable Energy Efficiency Project is moving ahead as planned and anticipated. The project's main highlights are summarized below:

- Original project schedule is impacted and approximately 5-8 months behind;
- Project is on budget;
- Project scope of work has been modified and IEUA is waiting for approval from the DOE; and,
- Consultant proposals are on-hold until DOE approves the scope of work modifications.